Cancelled 00-25

Federal Aviation Agency

ADVISORY CIRCULAR

AC NO: AC 00-13A

GENERAL

EFFECTIVE: 2/24/65

SUBJECT: RUNWAY VISIBILITY MEASUREMENTS

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1. PURPOSE. This Advisory Circular is issued to provide the latest information available on the installation and operational use of Runway Visibility Value (RVV) and Runway Visual Range (RVR) at civil airports in the United States. The major changes to the contents of Advisory Circular AC 00-13 are as follows:

   a. Deletion of the listing of specific RVR takeoff and landing minimums.

   b. Deletion of the outer compass locator as an operational requirement for the use of RVR for landing without regard to reported ceiling.

   c. Addition of provision for takeoffs without regard to reported ceiling.

2. CANCELLATION. Advisory Circular AC 00-13 is canceled.

3. BACKGROUND. Advisory Circular AC 00-13 was issued on July 16, 1963, to provide information on Runway Visual Range and Runway Visibility Value and the application of RVR and RVV reports in determining landing and takeoff weather minimums. This Advisory Circular updates the original material contained in AC 00-13.

4. DEFINITIONS.

   a. Prevailing visibility is the horizontal distance at which targets of known distance are visible over at least half of the horizon. It is determined by an observer viewing selected dark objects against the horizon sky during the day and moderate-intensity unfocused lights at night.

b. Runway Visibility Value (RVV) is the visibility along an identified runway. It can be measured by an instrument or by a human observer. Where a transmissometer is used for measurement, the instrument is calibrated in terms of a human observer, i.e., the sighting of dark objects against the horizon sky during daylight and the sighting of moderate-intensity unfocused lights of the order of 25 candlepower at night.

c. Runway Visual Range (RVR) in the United States is an instrumentally derived value that represents the horizontal distance a pilot will see down the runway from the approach end, or when additional transmissometers are installed, from that portion of the runway adjacent to the transmissometer location. It is based on the sighting of either high-intensity runway lights or on the visual contrast of other targets, whichever yields the greatest visual range.

(1) Runway visibility is defined in terms of the distance at which an observer can see a moderate-intensity light source (or other targets during daylight if they can be seen farther than lights). Runway visual range is defined in terms of the distance high-intensity runway lights can be seen (or other targets during daylight if they can be seen farther than lights). It is evident that the brighter the light, the farther it can be seen. It is clear then that the high-intensity runway lights, which have peak intensities measured in thousands of candlepower, can be seen at a much greater distance than a 25-candlepower light.

(2) The intensity of the high-intensity runway lights is controllable and the RVR reading of visibility indicated by the readout in the control tower takes this intensity setting into account. For example, when the runway edge light intensity (setting) is increased, the RVR readout increases; conversely, when the light setting is decreased, the RVR readout is automatically decreased. The primary advantage of an RVR reading as opposed to an RVV reading is that by taking into account the penetrating capability of the high-intensity runway lights, it is a more realistic and accurate indication of the visual cues which the pilot will have when on the runway.

5. TRANSMISSOMETER.

a. The instrument used to determine RVV and RVR is the transmissometer. It consists primarily of a projector, a detector, and either a meter or digital display instrument to indicate the transmission

of light through a selected portion of the atmosphere. The projector directs a steady light beam of constant intensity toward a receiver a known distance away. The receiver is a photoelectric detector which is sensitive to the intensity of the projected light beam. The intensity of the light received at the detector is dependent on the degree to which the path between the projector and the detector is obstructed by rain, snow, fog, haze, smoke, dust, etc. The projector and detector are spaced 500 feet apart and are at the present time installed adjacent to the touchdown area of the ILS runway. In the future, it is anticipated that one or more additional transmissometers may be located on other portions of the runway for the purpose of providing more representative reports.

b. The transmission value of the atmosphere as determined by the transmissometer is displayed on the readout equipment in the control tower as RVV or RVR. The earlier installations used meters calibrated in fractions of a mile to display Runway Visibility Value (RVV). Later installations are calibrated in feet to display Runway Visual Range (RVR). The earlier RVR systems use meter displays calibrated in feet and indicate RVR values from 2000 feet to 6000 feet in increments of 200 feet below 4000 feet and in increments of 500 feet above 4000 feet. Later RVR installations use computers which provide digital readouts to display RVR values from 1000 feet to 6000 feet in increments of 200 feet below 4000 feet and in increments of 500 feet above 4000 feet. The readout equipment is located in the United States Weather Bureau Office, IFR room, and control tower cab.

6. OPERATIONAL USE OF RVR AND RVV.

a. Whenever the control tower reports a visibility value specified as either Runway Visual Range (RVR) or Runway Visibility Value (RVV) for a particular runway of an airport, such visibility will control for all instrument approaches and for all takeoffs and landings on that runway, regardless of the reported prevailing visibility for the airport. For example, if the ILS weather minimums for a particular runway are 300-3/4, RVR 4000 feet, but the reported weather is ceiling 300 feet prevailing visibility 3/4 mile, with RVR being reported as 3000 feet; conditions are below minimums for landing on that runway. However, if a Runway Visual Range (RVR) or Runway Visibility Value (RVV) is not available for that particular runway, the ceiling and prevailing visibility minimums (300-3/4 in the example given) govern. RVR will be reported as inoperative (RVRNO) when either the transmissometer or the high-intensity runway edge lights are inoperative.

b. Another example which illustrates this applicability is as follows: VOR straight-in landing minimums at a particular location are 500-1 and the reported weather is 500-3/4 with an RVV for that runway of

one mile. In this case, even though the prevailing visibility is reported below minimums the RVV for that runway (one mile) is controlling and weather conditions are such that a landing may be made.

c. Takeoff and landing minimums are normally expressed in terms of both ceiling and visibility, usually measured some distance from the runway. An RVR reading provides a more accurate and realistic indication of the conditions which a pilot will actually encounter on the runway. Therefore, an RVR report for a particular runway may be utilized without regard to the reported ceiling only for straight-in approaches using ILS localizer or PAR whenever the reported RVR value is equal to or better than the authorized RVR minimum; provided the following aids and related airborne equipment are in satisfactory operating condition:

(1) ILS localizer plus (OM or LOM) or PAR.

(2) Standard approach light system and condenser discharge lights.

(3) All weather runway marking1/ or centerline runway lights.

(4) High intensity runway lights.

Thus, when conducting a non-precision approach (VOR, ADF, etc.) to a runway reporting RVR, the ceiling minimum specified in the instrument approach procedure is also applicable.

d. For takeoffs, RVR may be used without regard to reported ceiling whenever the reported RVR value for a particular runway is equal to or greater than the authorized RVR takeoff minimum for that runway.

e. When for any reason an RVR report is not available for landing or takeoff on a particular runway, both the ceiling and prevailing visibility will govern for takeoffs and landings on that runway.

f. The earlier RVR installations are only capable of readouts down to 2000 feet. Accordingly, whenever the RVR drops below 2000 feet on these runways, the RVR equipment has reached the limit of its capability and for practical purposes is inoperative. This condition is reported by the tower as "Runway Visual Range less than 2000 feet" and on the hourly sequence as "RVR 1900 minus." Whenever such a report is given, the RVR is below limits when the authorized RVR minimum is 2000 feet or greater. However, when in such case the authorized RVR minimum is less than 2000 feet, the prevailing

1/ It is important that runway paint markings be maintained in good condition, and clear of snow during winter operations.

visibility becomes the governing visibility value. For example, if takeoff minimums of 0-1/4 RVR 1600 are authorized and the RVR for a particular runway is reported as RVR 1900 minus, the flight may takeoff on that runway if the prevailing visibility for the airport is reported as 1/4 mile or more.

g. Visibility measurements at airports are presently reported in terms of statute miles or fractions thereof and in the case of RVR, in terms of feet. RVR equipment is not capable in all cases of reporting the precise increment of feet equal to the usually reported fractions of a statute mile. As previously stated RVR reports, when given for a particular runway, are controlling for all takeoffs and landings on, and approaches to, that runway. Therefore, in the event that an RVR report is given for a runway at which a specific RVR minimum visibility in feet has not been prescribed in the applicable instrument approach procedure, the following substitution will apply in determining compliance with visibility minimums. This substitution is also applicable to other situations where specific RVR minimums are not prescribed, such as when higher visibility minimums are prescribed due to inoperative components and when landing minimums are increased for air carrier pilots who have less than 100 hours as pilot-in-command of a particular type of airplane:

Prescribed Visibility Minimum	RVR Equivalent
1/2 mile	2400 feet
3/4 mile	4000 feet
1 mile	5000 feet
1-1/4 mile	6000 feet

h. In many nations RVR values are reported only in meters. As the RVR minimums applicable to United States air carriers conducting operations at foreign airports are prescribed in terms of feet, a substitution table is necessary. Conversion of the normally-reported metric values of RVR does not result in exact values equal to the RVR minimum in feet prescribed for United States air carrier operations, therefore, some adjustments have to be made in the conversion. The following substitution table, which represents a reasonable and workable conversion of the reported metric values of RVR, may be used at airports outside the United States where RVR values are not reported in feet or yards.

Applicable RVR Minimum	Equivalent Metric Value Required
1000 feet	300 meters
1100 feet	350 meters
1300 feet	400 meters
1500 feet	450 meters
1600 feet	500 meters
1800 feet	550 meters
2000 feet	600 meters
2300 feet	700 meters
2400 feet	750 meters
2600 feet	800 meters
3000 feet	900 meters
3300 feet	1000 meters
4000 feet	1200 meters

7. RVR SYSTEMS CAPABILITY.

a. The advantages of RVR are that it accounts for the ability of high-intensity runway lights to penetrate obstructions to vision such as fog and haze. Also, the visibility is determined in the area where the landing or takeoff is to be made and not from a point which may be a considerable distance away from the runway used. Further, it is not subject to variations that would exist between different human observers, and it furnishes a new report approximately each minute.

b. A limitation of RVR is that it is only a sample of the transmissivity of the atmosphere measured over a 500-foot baseline and extrapolates RVR values up to 6000 feet. Obviously, the visibility may vary along the runway from that sampled and this variation will not be reflected in the reported RVR value. However, experience has shown that in a large majority of cases it is representative of the visibility along the entire runway distance. Also, it should be understood that RVR is not a slant-range visibility along the glide path. It is what a pilot touching down or taking off on the runway would see in terms of high-intensity runway lights while in the touchdown area.

8. REPORTING OF RVR.

a. When RVR becomes operational at an airport, it is reported irrespective of the subsequent operation or nonoperation of navigational aids required for takeoff or landing. Failure of the display equipment in the tower does not preclude valid RVR reports being given to the pilot provided they can be relayed from the U. S. Weather Bureau Office to the tower. In view of the increased

accuracy of runway visibility measurements, runway observers are making observations of RVV (not RVR) at 10 select airports during conditions of low visibility when the transmissometer fails or when the designated landing or takeoff runway is not equipped with a transmissometer.

b. When RVR on the landing runway is 6000 feet or less and/or prevailing visibility is 1½ miles or less, RVR will be reported to pilots by the tower or approach control in initial contact and subsequently as requested.

c. When RVR on the landing runway is 4000 feet or less, RVR will be reported to pilots by the tower or approach control on the initial contact and subsequently as required by virtue of changing visibility conditions.

d. When RVR on the departure runway is 6000 feet or less and/or the prevailing visibility is 1 mile or less, the RVR will be reported to each pilot intending to depart on such runway.

e. Whenever a pilot requests the RVR reading for a particular runway it will be reported to him by the tower or approach control if available.

f. On airports equipped with one or more RVR installations, a ten-minute mean of the RVR values of all runways reporting RVR is contained in the hourly weather sequence reports. This is shown on the sequence report as a Visual Range and is given in feet. This value does not pertain to, nor control operations on any individual runway. It is given as an information item to assist in flight planning. It is anticipated that this ten-minute average will soon be given, together with the highest and the lowest one-minute value recorded during this period. A six-number group will be used, the first pair indicating the lowest one-minute value, the second pair, the ten-minute average, and the third pair, the highest one-minute value occurring in the preceding ten-minute period. However, the RVR reported to you by the control tower is a one-minute mean of the RVR value for a particular runway and is governing for operations on that runway except as noted in 6(f) above.

9. PROGRESS OF INSTALLATION PROGRAM, AS OF 10/1/64.

Transmissometers installed	197
RVR dial indicator readouts installed	29
RVR digital indicator readouts installed	12
RVR systems installed	41
RVV systems installed	156
ILS systems installed	244
Standard approach light system installed	204

The U. S. Weather Bureau has 274 transmissometers either delivered or on order, of which 197 have been commissioned. The present plan is that RVR equipment will serve each runway equipped with an instrument landing system and takeoff runways where deemed necessary. All presently installed Runway Visibility Systems will be converted to Runway Visual Range Systems as fast as computers and digital readout equipment become available.

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